

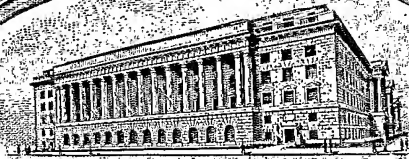
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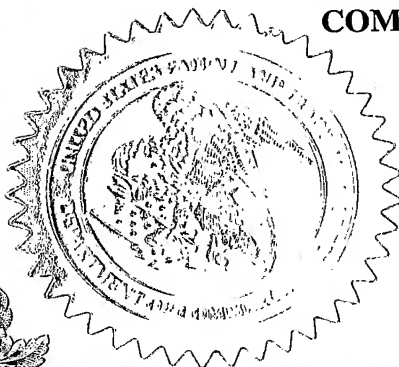
APPLICATION NUMBER: 60/551,146 ✓

FILING DATE: March 08, 2004 ✓

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# PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label No. EV 312 069 318

Date of Deposit: March 8, 2004

## INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
JAVIER SAI SHANKAR KIRAN JOERG	DEL PRADO PAVON NANGADOPALAN CHALLAPALI HABETHA	OSSINING, NEW YORK TARRYTOWN, NEW YORK NEW CITY, NEW YORK AACHEN, GERMANY

☐ Additional inventors are being named on the \_\_\_\_\_ separately numbered sheets attached hereto

TITLE OF THE INVENTION (280 characters max)

METHOD TO ENABLE WUSB APPLICATIONS IN A DISTRIBUTED UWB MAC

## CORRESPONDENCE ADDRESS

Direct all correspondence to:

☒ Customer Number 24737

OR Type Customer Number here

24737

☐ Firm or Individual Name PHILIPS INTELLECTUAL PROPERTY & STANDARDS

Address P.O. BOX 3001

Address 345 SCARBOROUGH ROAD

City BRIARCLIFF MANOR State NEW YORK ZIP 10510-8001

Country USA Telephone (914) 333-9608 Fax (914) 332-0615

## ENCLOSED APPLICATION PARTS (check all that apply)

☒ Specification Number of Pages 12 ☐ CD(s), Number \_\_\_\_\_

☐ Drawing(s) Number of Sheets \_\_\_\_\_ ☐ Other (specify) \_\_\_\_\_

☐ Application Data Sheet. See 37 CFR 1.76

## METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees

FILING FEE  
AMOUNT (\$)

☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 14-1270

160.00

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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: \_\_\_\_\_

Respectfully submitted,  
SIGNATURE

Date MARCH 8, 2004

TYPED or PRINTED NAME Aaron Waxler

REGISTRATION NO.: 48,027  
(if appropriate)

Docket Number: US040143

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**Title of the invention:**

**Method to enable WUSB applications  
in a Distributed UWB MAC**

**Inventors' name(s) + e-mail  
address(es):**

Javier del Prado Pavon: [Javier.delprado@philips.com](mailto:Javier.delprado@philips.com)  
Sai Shankar N: [Sai.shankar@philips.com](mailto:Sai.shankar@philips.com)  
Kiran Challapali: [kiran.challapali@philips.com](mailto:kiran.challapali@philips.com)  
Joerg Habetha: [joerg.habetha@philips.com](mailto:joerg.habetha@philips.com)

**Abstract of the invention:**  
(detailed description to be provided  
on next page)

This invention provides two novel ways to incorporate the host-device communication in wireless USB (WUSB). UWB MAC is considering the distributed MAC based that uses EDCA, enhanced NAV protection and DRP to exchange both isochronous and asynchronous data. This invention is concerned with data transfer between the devices and hosts that use DRP protocol.

In the first method, the host uses a multicast DRP (distributed reservation protocol) frame on behalf of devices to reserve wireless channel resources for data transfer between the host and the devices based on the device characteristics and what traffics they have. This provides a continuous reservation period wherein the host is able to receive data from all the devices in a simple TDMA fashion. In the second method the host uses a unicast DRP frame to device and negotiates the use of channel for data transfer between the device and the host. In this method the number of unicast frames sent for reservation depends on the number of devices.

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## **Detailed description of the invention**

*Please describe the invention using the headings below*

### **Background of the invention**

*Begin the description of the invention with a short discussion of what is already known. If possible, include references to public documents, such as articles in technical journals, proceedings of conferences, brochures, or patent documents.*

UWB MAC is considering the distributed MAC based that uses EDCA, enhanced NAV protection and DRP to exchange both isochronous and asynchronous data. Details of the distributed can be found in [1, 2 & 3]. In a wireless USB (WUSB) scenario there is one host and one or more devices that will transmit data to the host. In the wired USB scenario the host sends a token or a poll frame to the devices to request data from the devices. WUSB uses UWB MAC as a means to communicate to other devices over the wireless medium. The UWB MAC is distributed and there needs to be a method by which the host can reserve the channel resources on behalf of the devices so that the devices can transmit data when requested by the host. This disclosure provides two methods on reserving the wireless channel resources so that the devices can send data to the host.

**Method 1:** Multicast DRP protocol makes the host of the WUSB to initiate a multicast DRP frame to reserve wireless channel resources on behalf of the devices. All the devices that are associated to the host communicate the device characteristic beforehand, which is used by the host to reserve the wireless channel on behalf of the devices. The advantage of this system is that the overhead of reservation is one or slightly more than one frame. Also there is a one contiguous time period for use by the host to receive data from the devices. This contiguous period uses a protocol called micro-scheduling. The micro-scheduling protocol is being defined by the WUSB working group. Thus the multicast DRP is a simple way to incorporate micro-scheduling scheme that is present in the current WUSB specification. The disadvantage of this scheme is that if the devices are not in agreement with the hosts reservation then we need to initiate another multicast frame or do unicast reservations for those devices that did not agree with the initial multicast reservation.

**Method 2:** In the second method the host initiates a separate unicast DRP reservation to all the devices to set aside the channel resources. So the number of reservation frames that need to be sent on the channel is directly proportional to the number of devices. This reservation initiation is equivalent to the MMC command in the current WUSB specification. Once the reservation is set, the host can use a poll frame to request the device to transmit data. The poll frame can also be sent by the host using the EDCA channel access, which has the control of the medium for a time specified by the EDCA TXOP limit to request the devices to transmit data.

For both the methods the host needs to know the capabilities of the devices which is clearly indicated

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by the devices when they put the beacon. Also the host includes its capabilities in the beacon. For the method1, the DNTS slots within the micro scheduling DRP period is used by the device to indicate traffic or EDCA may be used for both the schemes.

#### References:

- [1] Enhanced NAV mechanism for optimal reuse of the spectrum, ID Number: 779489
- [2] Beaconsing Protocol for Ad-Hoc Networks, ID Number: 779458
- [3] Distributed Reservaton Protocol, ID Number: 299284
- [4] Micro-scheduling Specification, Revision 0.5

### Problems or disadvantages overcome by the invention

*Usually an invention solves a particular problem or removes some disadvantage of known methods/devices etc. Are the disadvantages/problems new or were they already known?*  
It provides a clean way to enable WUSB application in the DRP protocol.

### The essential feature(s) of the invention

*The measures/device features that are proposed to solve the problem, and the resulting advantages. If the invention is based on a new understanding (insight), please indicate this.*

This is a novel distributed protocol that provides a clear solution to incorporate WUSB data transfer.

### Detailed description of how to build and use the invention

*Here all options, alternatives, improvements and enhancements (which we call "embodiments") are described. You should always include at least one fully explained embodiment with all the necessary details. Please add drawings, graphs, test data etc. where appropriate.*

Implementing the above methods as part of the MAC protocol for WPAN will enable UWB MAC to incorporate WUSB data transfer without any changes in the USB specification. See attached for the invention detailed description:



"WUSB support.ppt"

### Applications of the invention

*Indicate here in which fields (technical, commercial) the invention can be applied. Please include any references to Philips products or projects relate to the invention.*

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This invention can be used in all devices that use distributed CSMA/CA protocol. This is particularly useful for UWB MAC.

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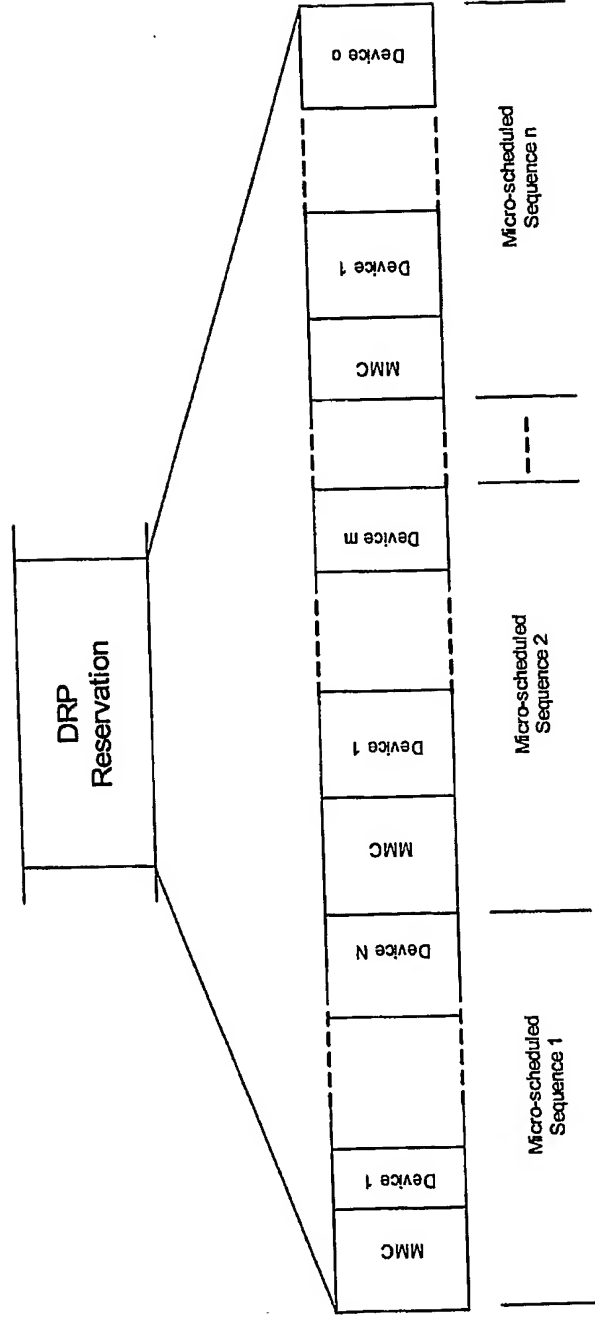
# Introduction

- The Goal
  - *To Support WUSB with the Philips Distributed MAC proposal*
- Different options are available
  - Need to evaluate which is the best option



## Option 1 – Multicast *DRP* with micro-scheduling

- The WUSB Host initiates a *DRP* multicast reservation with/on behalf of WUSB devices
- Once the reservation is established, micro-scheduling is used



## Option 1 – Multicast DRP with micro-scheduling

- Advantages
  - Uses Micro-scheduling as defined by WUSB protocol
- Issues that need to be solved
  - Multicast DRP negotiation may be complex
    - If one or more devices cannot accept it
    - If a new device comes up
  - The Host needs to control the medium during DRP and avoid contention with other devices

} → need to re-start negotiation?

## Option 2 – *DRP with “Poll” Frame*

- **DRP with Poll Frame:**
  - WUSB Host initiates (unicast) **DRP** with each device
    - Equivalent to MMC command
  - Once the negotiation is established
    - WUSB devices transmit during the reserved period
  - In addition we can define a **Poll** frame, which is sent by the WUSB Host to trigger transmission from WUSB device
- “**Poll**” frame could be also used for WUSB transmissions that do not require **DRP**
  - “**Poll**” Frame is sent using **EDCA**

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## Option 2 – *DRP* with “Poll” Frame

- Advantages
  - Natural extension of *DRP*
  - *WUSB* devices can be very simple
- Disadvantages
  - Higher *DRP* negotiation overhead
    - depending on number of *WUSB* devices
  - May be less efficient than micro-scheduling
    - *DRP* reservations may be spread throughout the superframe

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# WUSB Host Discovery and Device Notification

- WUSB Host discovery is done via the beacon
  - WUSB Host includes its capabilities in the beacon
- WUSB Device Notification Traffic
  - In option 1
    - DNTS slots within the micro-scheduling DRP Reservation can be used
    - EDCA may be a second option
  - In option 2
    - Device Notification traffic can be sent using EDCA

## (Slotted) DRP resolution

- Currently DRP resolution is in the order of usec.
- The problem is that multiple WUSB devices can make arbitrary reservations and it may be difficult to pack them in the channel.
- In order to achieve better packing and easy implementation, the Offset and Duration fields in the DRP reservations are set to a multiple of "X", where X, is the desired resolution of the DRP reservations or the size of the DRP slot, for example  $X = 625 \text{ usec}$